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Drought tolerant seeds: What's the future?

Carlos A. Urrea Florez
University of Nebraska-Lincoln, currea2@unl.edu

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Meeting the Challenge:
Farming In Uncertain Times
University of Nebraska Lincoln EXTENSION

By Carlos Urrea

Dry Edible Bean Breeder
UNL Panhandle Research and Extension Center

Outside of weeds, pests and disease, drought is the most important factor holding back crop yields. But it also is a normal, if unpredictable, occurrence in the Great Plains.

Drought reduces a crop's yield, quality, and often market value. The severity of yield reduction depends on the timing and duration of drought stress. Drought's impact can be amplified by other stresses, such as heat, temperature, disease, and poor soils.

In western Nebraska, irrigation not only mitigates drought's effects, but also provides greater profitability and income stability than dryland farming. However, in recent years, groundwater declines due to overuse or drought have resulted in pumping restrictions in many areas of Nebraska, and years of drought have reduced water storage in reservoirs, leading to allocations for surface irrigators. This has necessitated a shift to limited irrigation or a return to dryland crop production in some areas. The prolonged drought has magnified the resulting yield losses.

Drought effects, whether due to climate or changing agronomic practices, are not a new problem for growers. Breeding for drought tolerance has resulted in dramatic yield improvements in crops such as tomato, cowpea, and corn, but less so in dry bean.

Breeding for improved drought tolerance can be challenging. In part this is because differences in drought characteristics (including the timing, frequency, duration, and intensity) and environmental considerations (such as photoperiod length and soil type) can result in variable responses to drought stress. This makes it more difficult to identify potential sources of drought tolerance and incorporate them into cultivars that have desirable agronomic traits.

Efforts are under way both here and abroad to enhance yield of corn under drought stress. In Africa, CIMMYT (the international maize and wheat improvement center) has developed experimental genotypes that yielded at least 50 percent more under drought and nitrogen stress than commonly planted varieties or hybrids.

Monsanto has been working to enhance the drought tolerance of corn hybrids since 2003, and has been collaborating with BASF in these efforts for the last five years. During 2008 field trials in the western Great Plains, drought-tolerant corn had 6 to 10

percent greater yield, a gain of 7-10 bushels on an average of 70-130 bushels per acre. Plans are to develop hybrids that combine drought tolerance, insect resistance, and herbicide tolerance.

The UNL dry bean breeding program identified several sources of drought tolerance during 2005-2008 trials. Efforts are under way to identify the location of genes for drought tolerance in the bean genome to aid in developing commercial drought tolerant lines.

A shuttle breeding program that involves screening and selecting beans, first in Nebraska and then in Puerto Rico, has identified several sources of drought tolerance. Traditional breeding approaches will be used to incorporate drought tolerance into dry beans. Dry beans are not amenable to genetic engineering; therefore, no genetically modified (GM) or transgenic beans have been or are likely to be generated in the United States.